Mark Scheme 4751
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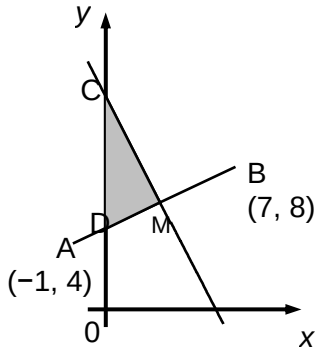
Section A

1	$y = 2x + 4$	3	M1 for $m = 2$ stated [M0 if go on to use $m = -½$] or M1 for $y = 2x + k$, $k \neq 7$ and M1indep for $y - 10 = m(x - 3)$ or (3, 10) subst in $y = mx + c$; allow 3 for $y = 2x + k$ and $k = 4$	3
2	neg quadratic curve intercept (0, 9) through (3, 0) and (−3, 0)	1 1 1	condone (0, 9) seen eg in table	3
3	$[a =]\frac{2c}{2-f}$ or $\frac{-2c}{f-2}$ as final answer	3	M1 for attempt to collect *a*s and *c*s on different sides and M1 ft for $a(2 - f)$ or dividing by $2 - f$; allow M2 for $\frac{7c-5c}{2-f}$ etc	3
4	f(2) = 3 seen or used $2^3 + 2k + 5 = 3$ o.e. $k = -5$	M1 M1 B1	allow M1 for divn by $(x - 2)$ with $x^2 + 2x + (k + 4)$ or $x^2 + 2x - 1$ obtained alt: M1 for $(x - 2)(x^2 + 2x - 1) + 3$ (may be seen in division) then M1dep (and B1) for $x^3 - 5x + 5$ alt divn of $x^3 + kx + 2$ by $x - 2$ with no rem.	3
5	375	3	allow $375x^4$; M1 for 5^2 or 25 used or seen with x^4 and M1 for 15 or $\frac{6\times5}{2}$ oe eg $\frac{6!}{4!2!}$ or 1 6 15 … seen [$^6C_4$ not sufft]	3
6	(i) 125 (ii) $\frac{9}{49}$ as final answer	2 2	M1 for $25^{\frac{1}{2}} = \sqrt{25}$ soi or for $\sqrt{25^3}$ M1 for $a^{-1} = \frac{1}{a}$ soi eg by 3/7 or 3/49	4
7	showing $a + b + c = 6$ o.e $bc = \frac{9^2-17}{16}$ =64/16 o.e. correctly obtained completion showing $abc = 6$ o.e.	1 M1 A1 A1	simple equiv fraction eg 192/32 or 24/4 correct expansion of numerator; may be unsimplified 4 term expansion; M0 if get no further than $\left(\sqrt{17}\right)^2$; M0 if no evidence before 64/16 o.e. may be implicit in use of factors in completion	4

8	$b^2 - 4ac$ soi use of $b^2 - 4ac$ < 0 k^2 < 16 [may be implied by k < 4] −4 < k < 4 or k > −4 and k < 4 isw	M1 M1 A1 A1	may be implied by k^2 < 16 deduct one mark in qn for ≤ instead of <; allow equalities earlier if final inequalities correct; condone b instead of k; if M2 not earned, give SC2 for qn [or M1 SC1] for k [=] 4 and − 4 as answer]	4
9	(i) $12a^5b^3$ as final answer (ii) $\frac{(x+2)(x-2)}{(x-2)(x-3)}$ $\frac{x+2}{x-3}$ as final answer	2 M2 A1	1 for 2 'terms' correct in final answer M1 for each of numerator or denom. correct or M1, M1 for correct factors seen separately	5
10	correct expansion of both brackets seen (may be unsimplified), or difference of squares used $4m^2$ correctly obtained [p =] [±]2m cao	M2 A1 A1	M1 for one bracket expanded correctly; for M2, condone done together and lack of brackets round second expression if correct when we insert the pair of brackets	4

Section B

11	**iA**	0.2 to 0.3 and 3.7 to 3.8	1+1	[tol. 1mm or 0.05 throughout qn]; if 0, allow M1 for drawing down lines at both values	2
	iB	$x + \frac{1}{x} = 4 - x$ their $y = 4 - x$ drawn	M1 M1	condone one error allow M2 for plotting positive branch of $y = 2x + 1/x$ [plots at (1,3) and (2,4.5) and above other graph] or for plot of $y = 2x^2 - 4x + 1$	
		0.2 to 0.35 and 1.65 to 1.8	B2	1 each	4
	ii	(0, ±√3)	2	condone y = ±√3 isw; 1 each or M1 for $1 + y^2 = 4$ or $y^2 = 3$ o.e.	2
	iii	centre (1, 0) radius 2 touches at (1, 2) [which is distance 2 from centre] all points on other branch > 2 from centre	1+1 1 1	allow seen in (ii) allow ft for both these marks for centre at (−1, 0), rad 2; allow 2 for good sketch or compass-drawn circle of rad 2 centre (±1, 0)	4

12	**i**	(3, 6)	2	1 each coord	
		grad AB = (8 − 4)/(7 − −1) or 4/8	M1	indep obtained	
		grad normal = −2 or ft	M1	for use of $m_1m_2 = -1$; condone stated/used as −2 with no working only if 4/8 seen	
		perp bisector is $y - 6 = -2(x - 3)$ or ft their grad. of normal (not AB) and/or midpoint	M1	or M1 for showing grad given line = −2	
		correct step towards completion	A1	and M1 for showing (3, 6) fits given line	6
	ii	Bisector crosses y axis at C (0, 12) seen or used	M1	may be implicit in their area calcn	
		AB crosses y axis at D (0, 4.5) seen or used	B2	M1 for 4 + their grad AB or for eqn AB is $y - 8$ = their ½ $(x - 7)$ oe with coords of A or their M used	
		½ × (12 − their 4.5) × 3 (may be two triangles M1 each)	M2	or M1 for $[MC]^2 = 3^2 + 6^2$ or 45 or $[MD]^2 = 3^2 + 1.5^2$ or 11.25 oe and M1 for ½ × their MC × MD; all ft their M	
		45/4 o.e. without surds, isw	A1	MR: AMC used not DMC: lose B2 for D but then allow ft M1 for MC^2 or MA^2 $[=4^2 + 2^2]$ and M1 for ½ × MA × MC and A1 for 15	
				MR: intn used as D(0, 4) can score a max of M1, B0, M2 (eg M1 for their DM = √13), A0	
		alt allow integration used: $\int_0^3 (-2x+12)\mathrm{d}x \ [=27]$	M1	condone poor notation	
		obtaining AB is $y - 8$ = their ½ $(x - 7)$ oe [y = ½ x + 4.5]	M1	allow if seen, with correct line and limits seen/used	
		$\int_0^3 (\frac{1}{2}x+4.5)\mathrm{d}x$	M1	as above	
		= 63/4 o.e. cao	A1	ft from their AB	
		their area under CB − their area under AB	M1	allow only if at least some valid integration/area calculations for these trapezia seen	
		= 45/4 o.e. cao	A1	if combined integration, so 63/4 not found separately, mark equivalently for Ms and allow A2 for final answer	6
13	**i**	$x - 2$ is factor soi	M1	eg may be implied by divn	
		attempt at divn by $x - 2$ as far as $x^3 - 2x^2$ seen in working	M1	or other factor (x^2 ….−1) or ($x^2 + 2x$...)	
		$x^2 + 2x - 1$ obtained	A1	or B3 www	
		attempt at quad formula or comp square	M1	ft their quadratic	
		$-1 \pm \sqrt{2}$ as final answer	A2	A1 for $\frac{-2 \pm \sqrt{8}}{2}$ seen; or B3 www	6

	ii	f(x − 3) = (x − 3)^3 − 5(x − 3) + 2 (x − 3)(x^2 − 6x + 9) or other constructive attempt at expanding (x − 3)^3 eg 1 3 3 1 soi x^3 − 9x^2 + 27x − 27 − 5x + 15 [+2]	B1 M1 A1 B1	or (x − 5)(x − 2 + $\sqrt{2}$)(x − 2 − $\sqrt{2}$) soi or ft from their (i) for attempt at multiplying out 2 brackets or valid attempt at multiplying all 3 alt: A2 for correct full unsimplified expansion or A1 for correct 2 bracket expansion eg (x − 5)(x^2 − 4x + 2)	4
	iii	5 $2 \pm \sqrt{2}$ or ft	B1 B1	condone factors here, not roots if B0 in this part, allow SC1 for their roots in (i) − 3	2